CH2M HILL
2485 Natomas Park Drive
Suite 600
Sacramento, CA 95833
Tel 916.920.0300
Fax 916.920.8463

July 16, 2007

Mr. Lance Shaw
Project Manager
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

Re: **Testimony Regarding Plumes and Aviation**
Russell City Energy Center Amendment No. 1 (01-AFC-7C)

Dear Mr. Shaw:

Please find attached one original and 12 copies of the Testimony Regarding Plumes and Aviation filed in support of the Petition for Amendment No. 1 for the Russell City Energy Center, Hayward, California (01-AFC-7C).

If you have any questions about this matter, please contact me at (916) 286-0278.

Sincerely,

for Jeannette Harris

Douglas M. Davy, Ph.D.
AFC Project Manager

Attachment

cc: M. Argentine
G. Wheatland

Supplemental Filing

Testimony Regarding

Thermal Plumes and Aviation

In support of the

Amendment Petition No. 1

for the

Russell City Energy Center

Hayward, California

(01-AFC-7C)

Submitted to the:

California Energy Commission

Submitted by:

Russell City Energy Center, LLC

With Technical Assistance by:

CH2MHILL

Sacramento, California

July 16, 2007

Contents

Chapter 1: Applicable Laws and Ordinances

A. Introduction

Q1 *Please state your name, address and your position.*

A1 Douglas M. Davy, Ph.D., Senior Project Manager, CH2M HILL Inc., 2485 Natomas Park Drive, Suite 600, Sacramento, California 95833

Q2 *Please describe the purpose of your testimony.*

A2 The purpose of my testimony is to demonstrate that (1) the Russell City Energy Center (RCEC) project is in compliance with Federal aviation laws, (2) that the RCEC is in compliance with the Hayward Municipal Code, specifically Section 10-6 and (3) that the aviation laws and ordinances of Australia are not applicable to the RCEC. This testimony will also address and correct portions of the Staff Assessment (SA) regarding these issues.

Q3 *What is your recommendation on this issue?*

A3 We ask the Commission to find that the RCEC complies with all applicable LORS, including Federal Aviation Administration (FAA) laws and regulations and the Hayward Municipal Code. We ask that the Commission find that thermal plumes from the RCEC stacks and cooling tower do not create a significant adverse environmental impact. Finally, as the FAA says, to make a safe situation even safer, we recommend that a Notice to Airmen (NOTAM) be issued indicating the location of the RCEC and advising avoidance in overflight.

B. The RCEC Complies with Federal Aviation Laws

Q4 *Which agency regulates navigable airspace in the United States?*

A4 Navigable airspace is regulated by the FAA.

Q5 *What is the FAA's authority over the RCEC?*

A5 Under 49 USC 44718, the Secretary of Transportation must require a person to

> …give adequate public notice... of the construction or alteration, establishment or extension, or the proposed construction, alteration, establishment, or expansion, of any structure... when the notice will promote:
>
> (1) safety in air commerce, and

> (2) the efficient use and preservation of the navigable airspace and of airport traffic capacity at public-use airports.

To this end, 14 CFR Part 77 was issued prescribing that notice shall be given to the Administrator of the FAA of certain proposed construction or alteration. In administering 14 CFR Part 77, the FAA's prime objectives are to ensure the safe and efficient use of the navigable airspace. The FAA recognizes that there are varied demands for the use of airspace, both by aviation and non-aviation interests. When conflicts arise out of construction proposals, the FAA emphasizes the need for conserving the navigable airspace. In the words of FAA Advisory Circular 70/7460.2K (3/1/00),

> "…early notice of proposed construction or alteration provides the FAA the opportunity to:
>
> - Recognize potential aeronautical hazards to minimize the adverse effects to aviation.
> - Revise published data or issue a NOTAM to alert pilots to airspace or procedural changes made as a result of the structure.
> - Recommend appropriate marking and lighting to make objects visible to pilots….
> - Depict obstacles on aeronautical charts for pilotage and safety.

Q6 Who must file the Form 7460?

A6 There are several different categories. The category that is most applicable to RCEC is any person who intends to sponsor construction is required to submit notice to the FAA Administrator if the proposed construction or alteration is greater than 200 feet above ground level at its site.

Q7 Does the RCEC meet this category?

A7 The maximum stack heights of the RCEC are 145 feet above ground level; therefore, the RCEC was not required to file a Form 7460. However, we did so out of an abundance of caution, in order to inform the FAA of the facility and to ensure that the FAA had no concerns regarding any potential aeronautical hazards or the use of navigable airspace.

Q8 Did RCEC file a form 7460?

A8 Yes, we filed two forms 7460-1 on March 7, 2007; one for each of the RCEC's exhausts stacks. Copies of the forms are included as Attachment 1 to my testimony.

Q9 Did the FAA approve the form 7460?

A9 Yes, the FAA released Determinations of No Hazard to Air Navigation regarding the RCEC stacks on March 26, 2007 (Aeronautical Studies #2007-AWP-1245-OE and #2007-AWP-1246-OE). Copies of the determination notices are included as Attachment 2 to my testimony.

Q10 The SA states that the form did not include any discussion about plumes generated by the RCEC. (Staff Assessment, 4.10-14) Is that correct?

A10 Yes. In discussions on February 23, 2007, the FAA personnel indicated that Form 7460-1 requires information regarding structures and does not require, or even request, information regarding exhaust discharges.

Q11 The SA states that the "FAA determination did not consider the plumes that would be generated by the project and potential adverse impacts on aircraft safety" (Staff Assessment, 4.10-14.") Is that correct?

A11 No it is not. The Form 7460-1 we filed clearly identified the structures as exhaust stacks from a power plant. The FAA is certainly aware of the phenomena of thermal plumes. When I discussed this matter with Joe Rodriguez of the FAA's office in Burlingame and asked him whether or not we should provide additional information about exhaust plumes to the FAA group in Hawthorne that reviews the forms, he advised me to wait until we heard from the FAA 7460 review group and respond to any request for additional information at that time. We proceeded as Mr. Rodriguez advised. The FAA did not request any additional information regarding plumes. Therefore, it is reasonable to conclude that the FAA considered the location of the facility in relation to the airport, the height of the stacks and the nature of the facility and concluded that neither the stacks nor the plumes posed a potential aviation hazard or would cause an adverse effect on aviation.

Q12 Has the FAA conducted a risk analysis of overflights of thermal plumes from industrial sources?

A12 Yes, it has. The Federal Aviation Administration's safety analysis report titled *Safety Risk Analysis of Aircraft Overflight of Industrial Exhaust Plumes* is an important document recently (January 2006) prepared and formally released (by John McGraw, Manager of the FAA Flight Technologies and Procedures Division on January 20, 2006), that considers all of the reported flight incident and accident reports for the past 30 years.

Q13 How was the analysis conducted?

A13 The FAA conducted a search of more than 671,000 pilot reports generated during the past 30 years in the National Aeronautics and Space Administration's Aviation Safety Reporting System (ASRS) and in addition examined more than 150,000 accident and incident reports from the FAA's own National Aviation Safety Data Analysis Center (NASDAC) Accident/Incident Data System (AIDS).

Q14 What did the analysis conclude?

A14 The search of the pilot reports indicated no documented instances of a pilot-reported incident involving a thermal exhaust plume. The search of accident/incident reports indicated that no accidents had taken place involving thermal plumes from industrial sources and only one, unconfirmed, incident, during that time. There were also two undocumented instances in which pilots intentionally flew through thermal plumes from a power plant and reported experiencing turbulence.

Q15 The SA states: "The FAA, in their Safety Risk Analysis, determined that, although the potential for risk is "…acceptably small,…intentional and/or inadvertent overflight of industrial plumes at low altitudes (less than 1,000 feet above) during high velocity operation of the facility (producing the plume; italics added*) (sic) could possibly result in aircraft upset and a resultant incident or accident." Is this an accurate characterization of the FAA safety analysis report's overall conclusions.*

A15 No, it is not an accurate characterization of the FAA study. While the SA quotes language that intentional or inadvertent overflight of industrial plumes "could possibly result in aircraft upset and a resultant incident or accident," the SA omits key findings of the FAA study that put this possibility in its proper context.

The Safety Analysis Report concludes that there has never been a documented instance of a reportable flight incident or accident in the United States resulting from industrial thermal plumes. This study was docketed in this proceeding as Attachment DR55-1 in response to Staff's Data Request #55 (see Exhibit 20). Staff is quoting from the study somewhat selectively, for the FAA study also says:

> Current regulations and advisories as well as the present Notice to Airmen (NOTAM) Temporary Flight Restrictions should preclude prudent pilots from flying through or near plumes, thereby making the aviation risk **essentially zero** (emphasis added).

Q16 The SA also states that the agency report "…also determined that low, close-in operations at small- to medium-sized airports by general aviation aircraft, particularly aircraft under 12,500 pounds and those in the Light Sport Aircraft (LSA) category, would be of greatest potential concern [FAA(b), Section 4, bullet 3, p,15]." Is this an accurate characterization of the FAA study?

A16 Again, Staff's statements present a misleading impression of the FAA study's conclusions. While operations at smaller or medium airports are of greatest concern to the authors of the FAA study, even at these facilities and for smaller aircraft the risk is acceptably low. The FAA study explains why there is a low risk factor in the next paragraph of the study (not quoted by the SA):

> The SME team considered and discussed their belief that safety data which indicated few, if any accidents/incidents attributable to the

> issue may be a reflection of the cumulative actions over many years of prudent aviators and ATC personnel. This includes a knowledge of and training in established "see-and-avoid" techniques and/or mitigating operational procedures…. Moreover, rules and regulations restricting the altitude for overflight of power plant facilities coupled with pilot training, alerting, and the common sense aviator aptitude were determined to be the major factors in the scarcity of associated data and resultant low risk factor.

In addition, the SA fails to disclose that current FAA regulations, as described in the FAA study, currently restrict overflight of the RCEC site. In fact, Staff may be incorrectly interpreting FAA regulations (14 CFR 91.119) as allowing aircraft to fly as low as 500 feet above the RCEC site (SA Page 4.5-17, paragraph 3, seventh sentence): "The minimum altitude for fixed wing aircraft outside the traffic pattern (and over the site) is 500 MSL, except during takeoff and landing; helicopters may fly lower [FAA(c)][1]." In fact, the minimum safe altitude over the RCEC could be interpreted as being higher than 1,000 feet above the highest obstacle. As the Safety Analysis Report and 14 CFR 91.119 state, except for takeoff and landing:

…no person may operate an aircraft below the following altitudes:

(b) *Over congested areas*. **Over any congested area of a city, town, or settlement** (emphasis added), or over any open air assembly of persons, an altitude of 1,000 feet above the highest obstacle within a horizontal radius of 2,000 feet of the aircraft.

(c) *Over other than congested areas*. An altitude of 500 feet above the surface, except over open water or sparsely populated areas. In those cases, the aircraft may not be operated closer than 500 feet to any person, vessel, vehicle, or structure.

(d) *Helicopters*. Helicopters may be operated at less than the minimums prescribed in paragraph (b) or (c) of this section if the operation is conducted without hazard to persons or property on the surface.

Although the FAA has not formally interpreted or defined the meaning of "congested area," it is clear that it refers to an area within which there could be a congregation of people or many structures. As the FAA's *General Aviation Operations Inspector's Handbook, Order 8700.1* states:

> The congested nature of an area is defined by what exists on the surface, not the size of the area. While the presence of the nonparticipating public is the most important determination of congested, the area may also be congested with structures or objects. An area considered congested for airplane operations could be equally congested for helicopters.

[1] The Staff's reference to 14 CFR 90.119 cites only subclauses (c) and (d), and not (b), which governs congested areas.

Generally speaking, the purpose of the FAA minimum altitude restriction rule is to require sufficient clearance over populated and heavily used areas such that an aircraft could make an emergency landing without endangering people or property.

Therefore, the minimum safe flight altitude outside of the Traffic Pattern Zone could be considered to be 1,000 feet plus the height of the tallest structure within 2,000 feet of the aircraft, not 500 feet above sea level, as the SA states. In the vicinity of the RCEC, the tallest nearby structure would be the KFAX radio broadcast antennae, at 228 feet above ground level. Therefore, the minimum safe altitude for fixed-wing aircraft within 2,000 feet of the KFAX towers would be 1,228 feet above ground level. The farthest point of the RCEC parcel is 1,720 feet from the nearest of the four KFAX towers.

Even assuming that the project area were to be considered "other than congested" because of its non-residential character, the minimum allowed elevation would be 645 feet above the ground surface over the RCEC once the plant is constructed (145 feet plus the 500 feet minimum distance). The minimum safe altitude would be 728 feet above the neighboring KFAX antennae.

FAA regulations ([d] above) do allow helicopters to fly safely to lower altitude. This does not permit helicopters, however, to operate recklessly or to disobey the basic aviation safety principle of "see and avoid." The Hayward Executive airport's pamphlet titled "Noise Abatement and Operational Procedures Guide for Helicopter Operations" depicts the airport's authorized helicopter approach zones and departure routes. These designated routes do not extend in the direction of or over the RCEC site and the RCEC is outside the boundary of the heliport's southwestern approach zone.

Q17 The SA states: "However, the FAA has no authority over off-airport land uses and, while the agency can provide guidance regarding land use safety compatibility in the immediate vicinity of the runway, runway protection zones at each end of the runway, and navigable airspace, its safety criteria only apply to property controlled by the airport proprietor (Caltrans 2002, p.9-4)." Is this a correct statement of the FAA's authority?

A17 No, it is not. While the FAA's authority may not include direct land use jurisdiction superseding that of a city, for example, its authority to review and approve proposed land uses extends for several miles beyond a given airport, depending on the airport runway size and instrument rating, as specified in 14 CFR 77. For off-airport uses, parties must receive a Notice of No Hazard to Air Navigation before local agencies can make a finding of no adverse impact to public safety and grant a permit to construct. The FAA's authority is thus not limited to property controlled by the airport proprietor.

Q18 Are there any other FAA regulations or standards applicable to the RCEC?

A18 Yes. FAA Notice to Airmen (NOTAM), issued October 8, 2004 replaced an earlier temporary advisory NOTAM released shortly after September 11, 2001 The NOTAM is included as Attachment 3 to my testimony and states the following:

> In the interest of national security, and to the extent practicable, pilots are strongly advised to avoid the airspace above, or in proximity to such sites as power plants (nuclear power plants, hydroelectric, or coal), dams, refineries, industrial complexes, military facilities and other similar facilities (NOTAM FDC 4/0811).

Q19 Are you familiar with other public airports that have operating power plants permitted by the FAA and constructed adjacent to runways and their track records regarding pilot complaints?

A19 The 830 MW High Desert Power Plant is near the Southern California Logistics Airport (former George Air Force Base) in Victorville, California. The plant has three exhaust stacks and a 12-cell cooling tower and was licensed by the CEC in May of 2000. The High Desert plant elements (cooling tower and stacks) that could produce thermal plumes are between 1,500 and 1,750 feet from the nearest point on the main runway, which is the end of the runway. According to the Airport Operations Manager, there have not been any complaints from pilots regarding thermal plumes originating from the power plant cooling tower or stacks since the plant went on-line in April of 2003 (electronic mail from Peter Soderquist, Director, Southern California Logistics Airport to Douglas Davy, July 11, 2007, Attachment 4 to this testimony).

C. The RCEC Complies with Hayward City Ordinances

Q20 Does the RCEC comply with Hayward Municipal Ordinance Section 10-6.35?

A20 Yes, it does. A letter from Jesús Armas, City Manager, City of Hayward to Shaelyn Strattan, CEC Staff, June 26, 2007 (Attachment 5 to my testimony) explains clearly why the RCEC is not inconsistent with the ordinance.

Q21 What does the Ordinance state?

A21 Ordinance Section 10-6.35 states as follows:

> <u>SEC. 10-6.35 USE RESTRICTIONS</u>. Notwithstanding any other provisions of this Article, no use may be made of land within any airport approach zone, airport turning zone or airport transition zone in such a manner as to create harmful electrical interference with radio communication between the airport and aircraft, make it difficult for flyers to distinguish between airport lights and other lights, result in harmful glare in the eyes of the flyers using the

> airport, impair visibility in the vicinity of the airport or otherwise endanger the landing, take off or maneuvering of aircraft.

In the first place, the RCEC would not be a land use that would "endanger the landing, takeoff, or maneuvering of aircraft." This is demonstrated conclusively in Chapters 2 and 3 of this testimony in a detailed modeling analysis of the plants potential to generate thermal plumes and a discussion regarding airport operations. In any case, the RCEC is located outside of the "traffic pattern zone" that is designated by the City of Hayward and approved by the Alameda County Airport Land Use Commission (ALUC) in determining compliance with this ordinance.

Q22 The Staff Assessment states the RCEC would be prohibited because the RCEC would generate thermal plumes that have the potential to endanger the maneuverability of aircraft within the "Airport Approach Zoning Plan boundaries." What are these boundaries and are they applicable to the project?

A22 The Airport Approach Zoning Plan boundaries were the boundaries in effect in 1963/64. Section 10-6.20 of the code defines the various airport zones as the zones "shown on a map designated as 'The Airport Approach Zoning Plan for Hayward Air Terminal, Hayward, Alameda County, California' on file at the office of the City Clerk.…" The map to which the 1964 ordinance refers, however, shows a single planning zone extending for 11,000 feet in all directions from a central point on the airport runway and designed to protect the main runway and a cross runway.

Q23 Is this map applicable to the RCEC site?

A23 The RCEC site is approximately 1.5 miles from the nearest Hayward Executive Airport runway and is within 11,000 feet of the central point depicted on the 1964 map. This map does not accurately portray the airport's contemporary configuration or contemporary airport land use planning zones and concepts, however, and is therefore, as determined by the City of Hayward, not applicable to RCEC.

The Hayward Executive Airport Master Plan was revised in 1984 and 2002. Neither the 1986 Alameda County Airport Land Use Policy Plan for Hayward Executive Airport, the Airport's own Master Plan, or the Caltrans California Airport Land Use Planning Handbook use the terminology "Airport Approach Planning Zone." Instead, the applicable safety zone map that is equivalent to the 1964 map is Exhibit 5B of the 2002 Hayward Executive Airport Master Plan, titled "California Land Use Safety Zones."

Q24 What does the City of Hayward consider to be the applicable airport land use planning safety zones?

A24 The City uses Exhibit 5B of the Hayward Executive Airport Master Plan for this purpose, as the City's letter clearly states, addressing this topic directly (a map showing this zone is attached the City's letter, see Attachment 5). These safety and planning zones include various runway protection zones located near the runway ends and a Traffic Pattern Zone, which extends about a mile from the runways. As the City Manager's letter puts it:

> Both the City's adopted 1984 Airport Master Plan and, more importantly, the adopted 2002 Airport Master Plan no longer include a cross wind runway and clearly show a different map now titled "California Land Use Safety Zones (copy attached)." That map shows an oval "Traffic Pattern Zone" consistent with the use of the runways as well as the Caltrans Division of Aeronautics Airport Land Use Planning Handbook and the draft update to the Airport Land Use Plan of the Alameda County Land Use Commission. Hayward's Airport Master Plan and the ALUC 1986 Policy Plan use the present terminology of Safety Zones rather than what was listed in the 1964 Ordinance.

The RCEC is more than 2,000 feet from the boundary of the Hayward Executive Airport's Traffic Pattern Zone.[2] The cooling tower is more than 2,900 feet from the zone boundary and the HRSG stacks are more than 3,000 feet from this boundary. The plant lies entirely outside of the designated Inner Turning Zones and Safety Zones, as depicted on Exhibit 5B of the 2002 Hayward Executive Airport Master Plan (California Land Use Safety Zones), which is attached to the City's letter (see Attachment 5 to this testimony). There is therefore no basis a finding of inconsistency with the Hayward Executive Airport Master Plan.

Q25 *The SA States (Page 4.5-1, second bullet) "Approval of the RCEC project, as amended, without meeting the requirements for a CUP, would be inconsistent with the HMC §10-1.1620(b)(1)(a) and §10-1.3225." Is this an accurate characterization?*

A25 It is not accurate. The RCEC would not cause a hazard to air navigation and is consistent with all applicable sections of the Hayward Municipal Code. The City's letter of June 26, 2007, cited above, explains explicitly why the City of Hayward considers the RCEC to be fully consistent with the City's Municipal Code.

Q26 *The SA States (Page 4.5-1, third bullet) "…the thermal plumes generated by the RCEC project have the potential to endanger the maneuverability of aircraft within the Hayward Airport Approach Zoning Plan boundaries." Is this an accurate characterization?*

A 26 Again, it is not. First of all, the thermal plumes from the project will not endanger aircraft (see later discussion). In addition, Staff incorrectly interprets the Hayward Airport Approach Zoning Plan boundaries and Hayward's Municipal Code, referencing zone definitions and boundaries that are outmoded and have been superseded.

Q27 *The SA states (Page 4.5-7, paragraph 3, first sentence) "The project site is … within the Hayward Airport Approach Zoning Plan area (AAZP) and the General Referral Area/Hazard Prevention Zone (HPZ), as identified in the 1986 Alameda County Airport Land Use Compatibility Plan (ALUCP), for this facility." Is this an accurate characterization?*

[2] The City's letter incorrectly states that the RCEC is 700 feet from the boundary of the Traffic Pattern Zone.

A27 The 1986 terminology regarding airport planning zones of Alameda County is not applicable to application of the Hayward city ordinance. Staff's analysis is based on a mistaken use of planning maps and concepts that are no longer applicable. Airport Approach Zone Plan Area is not a term that is used in either the 1986 Alameda County Airport Land Use Compatibility Plan or the 2002 Caltrans Airport Land Use Planning Handbook.

Q28 The SA, on page 4.5-1 refers to the potential for the project to introduce an aviation safety hazard into the Hayward Executive Airport operational airspace. Is this correct?

A28 It is not. The exhaust from the RCEC will not endanger the takeoff, landing, or maneuvering of aircraft, as will be explained in detail in a later section of this testimony. The term "operational airspace," furthermore, does not have a technical definition in either the 1986 Alameda County Airport Land Use Compatibility Plan, the 2002 Caltrans California Airport Land Use Planning Handbook, or Hayward Executive Airport Master Plan, although it is a term that is used in Australian airport planning.

Q29 The City's letter refers to an update to the ALUC's Airport Land Use Plan that is in draft. Does this document use the updated airport planning zone terminology?

A29 Yes. The ALUC's 1986 Alameda County Airport Land Use Policy Plan is being updated as the Alameda County Compatible Land Use Plan (CLUP) (draft July 2007). This document contains the Hayward Executive Airport CLUP draft update. The applicable planning zone boundaries discussed in this document include the "Airport Influence Zone," an irregularly shaped area extends for roughly 2 to 3 miles from the airport in all directions. This is the area within which the ALUC can examine a wide range of land uses in relation to airport operations.

The draft Hayward Executive Airport CLUP also discusses and maps a series compatibility zones that are devised in order to assist in land use planning in relation to three airport land use compatibility factors of noise, safety, and airspace protection. The compatibility zones include the Runway Protection Zone, Inner Safety Zone, Inner Turning Zone, Outer Safety Zone, Sideline Safety Zone, and Traffic Pattern Zone. Figure 3-8, Compatibility Factors, of the draft Hayward Executive Airport CLUP titled shows these zones, and is included as Attachment 6 to my testimony. This map also depicts the arrival and departure flight tracks and the fixed wing and helicopter flight tracks. While aircraft and public safety is an important land use planning consideration in any location, the Compatibility zones are areas within which potential to the public and aircraft from airport operations and are given special planning consideration. The RCEC is approximately 0.5 miles from the nearest of these zones (the Traffic Pattern Zone) and 0.5 miles or more from the nearest arrival or departure tracks depicted on the map.

Q30 Is the draft Hayward Executive Airport CLUP consistent with the Hayward Executive Airport Master Plan and its description of the land use compatibility zones?

A30 Yes. The CLUP uses the same terminology as the Master Plan and the draft CLUP's Compatibility Factors map shows essentially the same zones in the same places. As stated above, the RCEC is at least 0.5 miles from any of the CLUP's compatibility zones.

Q31 Does the draft Hayward Executive Airport CLUP describe or discuss the compatibility of specific land uses, such as power plants with the designated land use compatibility zones?

A31 Yes. The draft CLUP contains an extensive table of land uses and assigns them to compatibility categories in relation to the designated compatibility zones (Table 2-2, Safety Zone Compatibility Summary in the CLUP, included as Attachment 7 to my testimony). According to this table "electric plants" would be considered to be compatible uses within the Traffic Pattern, Outer Approach/Departure, and Sideline zones. Power plants would be conditionally approvable uses within the Inner Turning Zone and would be a prohibited use only within the Inner Approach/Departure and Runway Protection zones. The RCEC is at least 0.5 miles beyond any of the CLUP's compatibility zones.

D. Australian Aviation Standards Are Not Applicable to the RCEC

Q32 The SA (Page 4.5-18, paragraph 2), discusses Australian regulations regarding thermal plumes from industrial sources. Are these regulations applicable to the RCEC?

A32 No they are not. Staff accurately quotes Australian sources as stating that a thermal industrial exhaust plume with a velocity of 4.3 m/s (9.6 mph) "may cause damage to an aircraft airframe." The Civil Aviation Safety Administration of Australia (CASA), however, has been unable to document the source of or technical validity of this velocity as a screening level criterion. In response to my query about this topic, a CASA official informed me that "the origin of the 4.3 m/s trigger for plume rise assessment is somewhat loss [lost] in antiquity (personal communication, Dennis O'Leary, Manager, Communications and Marketing, Civil Aviation Safety Authority, Australia to Douglas Davy, May 13, 2007, Attachment 8 to this testimony)."

Q33 Does the FAA endorse the Australian approach to thermal plume assessment or the 4.3 m/s trigger for additional assessment?

A33 It does not. The Staff's analysis implies that the FAA endorses the 4.3 m/s criterion. The Safety Analysis Report, however, concludes: "The FAA does not necessarily approve/disapprove or warrant the data…" contained in the CASA's guidance document regarding thermal plumes, and goes on to say that Australia's procedures "*are far different from those in the United States* (emphasis added)." The FAA Safety Analysis Report thus does not endorse the Australian methods of analysis or analysis criteria.

Q34 Is 4.3 m/s thermal plume velocity a standard of impact significance in Australia?

A34 It is not. The Staff's analysis implies that 4.3 m/s is a standard of impact significance in Australia. Instead, 4.3 m/s is a trigger for further assessment, a screening-level criterion. As the FAA Safety Analysis Report states: "CASA requires the proponent of a facility with an exhaust plume which has a vertical velocity exceeding the limiting value... to be assessed for potential hazard to aircraft operation."

This CASA-required assessment takes into consideration several important factors, including the location of the exhaust plume source relative to airports and aircraft operating areas and, most importantly, the local meteorology. Even a very light wind will bend a thermal plume such that it will not reach as high as it would in dead calm conditions (which very seldom occur in any case). Applicants under CASA's review may use simplified thermal plume velocity calculations for initial screening to determine whether or not a meteorologically-based analysis is necessary, but do not use the simplified calculation for the full assessment because it does not consider local meteorology and is therefore unrealistic.

The CASA assessment process includes complex, numerical modeling of the thermal plume in the context of local meteorology. This process examines the *frequency distribution* of thermal plumes at the critical height threshold over a hypothetical year of meteorological conditions to determine whether there would be a potential hazard a significant percentage of the time, not simply whether or not a 4.3 m/s plume would ever occur.

If the meteorological assessment were to identify a potential hazard, the CASA generally manages any potential risks identified by instructing pilots to avoid flying over the industrial source. These principles are exemplified in the following quotations from the CASA's own guidance document, titled: "Guidance for Conducting Plume Assessments," June 2004 (CASA Advisory Circular AC 139-05[0]), as follows:

4.5 The risk posed by an exhaust plume to an aircraft during low level flight can be managed or reduced if information is available to pilots so that they can avoid the area of likely air disturbance.

…

7.6 In determining the need for a Danger Area, CASA will consider the severity and frequency of the risk posed to an aircraft which might fly through the plume. This assessment requires plume rise data to be provided as a probability distribution for the height and lateral limit of the critical vertical velocity.

7.7 Since plume rise and lateral dispersion are highly dependent on crosswind and the temperature differential between the plume and ambient air, this assessment requires the use of site specific metrological data throughout the full height of the plume.

In other words, thermal plume safety is assessed in Australia in terms of a probabilistic risk analysis based on detailed meteorological modeling, not by simply calculating whether or not a plume of 4.3 m/s would ever be generated by a particular source at a particular height under a hypothetical and unrealistic calm condition.

Additional testimony (next section) will show that the Applicant subjected the RCEC to just this sort of analysis and that this analysis clearly shows that the thermal plumes from the RCEC will not endanger the takeoff, landing, or maneuvering of aircraft.

Chapter 2: Thermal Plume Modeling Analysis

A. Introduction

Q1 Please state your names, addresses and your positions.

A1 My name is Gregory Darvin. My work address is 2925 Puesta del Sol, Santa Barbara, California 93105. I work as a Meteorologist for Atmospheric Dynamics, Inc.

My name is Christine Killip. My work address is 9 Sherwood Road, Toowong, Queensland 4066, Australia. I am an Atmospheric Scientist and Managing Director of Katestone Environmental.

Q2 Please describe the purpose of your testimony.

A2 The purpose of our testimony is to demonstrate the methodology used to determine the vertical velocities, the resultant vertical velocity elevations, and the frequency of occurrence, for thermal exhaust plumes from the Russell City Energy Center in Hayward, California. The Applicant commissioned an analysis to calculate the frequency of plume vertical velocities at various altitudes above the turbine and cooling tower stacks (Katestone Report, Exhibits 26, 27, and 29). Our testimony will describe the assessment and present the results of the assessment. We will also discuss several significant errors in the vertical plume assessment presented in the Staff's Assessment.

B. The Katestone Thermal Plume Study

Q3 Please describe the Katestone Study.

A3 The project owner commissioned Katestone Environmental to perform a plume vertical velocity assessment for the Russell City Energy Center (the Katestone Report). The assessment presented in the July 2007 Katestone Report and July 2007 Addenda 1 & 2 (Exhibits 26, 27, and 29) is based on the guidelines for aviation safety set out by the Australian Civil Aviation Safety Authority (CASA) and presented in *Guidelines for Conducting Plume Rise Assessments (CASA, 2004).* The aim of this assessment was to determine the heights at which the average vertical plume velocity emitted from the power station gas turbines and cooling towers would achieve 4.3 meters per second (m/s) under local meteorological conditions.

Q4 Why did you choose an Australian firm to conduct the study?

A4 During a RCEC workshop the CEC Staff indicated that it was reviewing a 2004 safety advisory circular [AC 139-05(0)], prepared by the Australian Government Civil Aviation Safety Authority (CASA), that noted Australian "aviation authorities have established that an exhaust plume with an average vertical velocity in excess of 4.3 m/s may cause damage to an aircraft airframe or upset an aircraft when flying at low levels" Staff indicated that it was considering adopting the Australian safety advisory circular as the standard for determining a significant environmental impact from power facility thermal plumes in California. The general CASA procedure is to determine the height at which the plume (or plumes) could exceed an ***average*** in-plume vertical velocity threshold of 4.3 m/s and to determine the dimensions of the plume in these circumstances. The frequency of in-plume vertical velocities at the lowest height an aircraft may travel over the site and at other heights are also determined.

The Project Owner does not believe it is appropriate to apply an Australian advisory circular to a California project and we believe the Staff has incorrectly applied the standard, as is discussed in Chapter 1 of this testimony. Nevertheless, assuming for the sake of discussion that the Australian standard could be applied to this project, we wanted to know whether this project would meet Australian standards using the Australian guidelines for conducting vertical plume velocity assessments. Katestone Environmental is the Australian firm which has developed an accepted CASA-approved vertical plume model. Therefore, the Project Owner commissioned Katestone Environmental to perform the assessment.

The CASA Advisory Circular indicates that "plume dynamics should consider average plume velocities." Past discussions between Katestone Environmental and CASA have concluded that analysis of the average plume height and downwind distance is appropriate for these assessments. While there are some sections of the plume that may have a vertical velocity higher than that for the average plume height and downwind distance, these peak plume height predictions do not assess aviation safety risk appropriately.

Q5 *Please describe how the Katestone Report was prepared.*

A5 In Australia, CASA requires that the developer of a proposed project with an exhaust plume that has an average vertical velocity exceeding the limiting value (4.3 m/s at the Obstacle Limitation Surface or at 110 meters above ground level anywhere else) to assess the potential hazard posed by the plume to aircraft operations. CASA's Advisory Circular provides a recommended methodology that adopts a mathematical model named The Air Pollution Model (TAPM) to conduct plume rise assessments for single exhaust plumes. The CASA Advisory Circular does not specify a method to account for interactions between multiple plumes but allows for the use of alternative techniques to address this phenomenon. Katestone Environmental has developed a method that uses the TAPM vertical winds or a calm wind case to assess the average plume vertical velocity and extent due to two or more plumes. The Katestone methodology is described in detail in a technical paper by Peter Best et al. (2003), which has been referenced by CEC Staff, and is included as an attachment to the Katestone thermal plume study report (Exhibit 26). This method has been used with the meteorological data derived from TAPM to calculate the frequency, plume height, plume characteristics and downwind distance of the plume for vertical plume velocities greater than 4.3 m/s. Katestone Environmental has used this methodology throughout Australia and CASA has accepted the methodology for these projects.

The methodology presented and used in this assessment has been based on well-verified laboratory and theoretical treatments of the rise and spread of a buoyant jet, both into a still ambient environment and into a light crosswind. This treatment (developed by Dr. Kevin Spillane) covers in detail the initial dynamics of the plume as it exits the stack and the entrainment of ambient air into the plume as it rises directly above the stack. This method also considers the enhancement of vertical velocities that may occur if the plumes from multiple stacks merge and form a higher buoyancy, combined plume.

The Project Owner asked Katestone Environmental to employ two separate approaches to assess the vertical plume velocities.

- Approach 1 – is a worst-case assessment that assumes calm winds for the entire length and height of the plume. The most important meteorological conditions that could result in significant plume rise and potentially high vertical velocities at significant elevation are calm or light winds from ground level throughout the lower atmosphere. Based on the results of the TAPM-generated winds along with site-specific weather data, the indication is that the scenario of calm wind (i.e., zero m/s) throughout the lower atmosphere is extremely conservative and unlikely to happen in reality.

- Approach 2 – is a realistic scenario using vertical wind profiles generated by a prognostic wind field model for an entire year.

Both approaches used worst-case winter stack parameters for the turbines and cooling tower cells, which are based on a 38ºF ambient air temperature, in order to calculate the maximum expected plume velocities. Thus, for both approaches, the model is conservative in that it applies a 38ºF ambient air temperature winter condition to all of the projected plume calculations and does not take into consideration any daily or seasonal variation in temperatures.

CASA guidelines require the plume analysis to be conducted with site representative meteorology rather than the use of calm winds. Specifically, CASA states:

> To date, proponents of these developments have used a number of models to estimate the likely rise and lateral dispersion of the exhaust plume. In the absence of reliable meteorological data, plume rise has often been assessed in still air conditions. Whilst this represents a worst case scenario, the probability of this

occurrence in actual weather conditions at the development site is usually quite low.

Q6 *Please describe the results of the realistic scenario.*

A6 A one-year meteorological simulation was prepared using the TAPM model utilizing synoptic data and project site data for the year 1994 to quantify:

(a) The critical plume height. The critical plume height is the height at which the vertical velocity of the plume falls below 4.3 m/s; and

(b) How frequently critical plume heights of various magnitudes are likely to occur.

Results for the proposed RCEC for full-load operations are presented in Table 1. This table includes the results of the merged plumes using the Katestone Methodology for the nine cooling tower plumes and two gas turbine plumes under two different operating scenarios.

The results in Table 1 show that the critical plume heights are predicted to be below 183 meters (600 feet) for 99.80% of the time for the two gas turbine plumes, and below 93 meters (305 feet) for 99.95% of the time for the nine cooling tower plumes.

TABLE 1
Results for critical plume height for the proposed RCEC project and the proportion of the simulation year that the critical height is exceeded for merged plumes, using the Katestone Method and TAPM meteorology.

Percent of time	Critical Plume Height (Meters Above Ground)		
	Two GTs[3] Scenario 1	Two GTs Scenario 2	Nine CTs
90	64	65	28
80	68	68	31
70	72	73	34
60	76	77	37
50	80	82	42
40	86	87	47
30	92	94	53
20	101	104	58
10	116	119	64
9	118	121	65
8	120	123	66
7	122	126	67
6	125	129	69

[3] Combustion turbine Scenarios 1 and 2 are different power plant operating scenarios that involve different stack airflow assumptions (duct-firing and non-duct firing cases) that are described in the Katestone Addendum Report (Exhibit 27).

TABLE 1
Results for critical plume height for the proposed RCEC project and the proportion of the simulation year that the critical height is exceeded for merged plumes, using the Katestone Method and TAPM meteorology.

Percent of time	Critical Plume Height (Meters Above Ground)		
	Two GTs[3] Scenario 1	Two GTs Scenario 2	Nine CTs
5	128	134	70
4	132	140	73
3	136	147	76
2	142	154	80
1	150	162	84
0.5	156	171	87
0.3	159	177	89
0.2	161	182	90
0.1	167	187	92
0.05	175	195	93

Q7 *Please describe the results of the calm winds, worst-case scenario.*

A7 Assuming calm wind for the entire length and height of the plume in order to assess the absolute worst-case results produces the following (Table 2):

TABLE 2
Summary of heights where the vertical velocity is reduced to 4.3 m/s for single and multiple plumes for worst-case calm wind scenario.

Scenario	Critical Plume Height (Meters Above Ground Level)		
	Gas Turbine – Scenario 1	Gas Turbine – Scenario 2	Cooling Tower
Single Plume	198 meters	208 meters	105 meters
Merged Plume	285 meters	309 meters	315 meters

In reality, wind speed and direction can vary dramatically with height, especially in a coastal environment and the above results are very conservative indications of adverse conditions. The important factor for a given location is the appropriateness of available information for estimating true wind and temperature profiles throughout a typical year. Theoretical predictions, as shown in Table 2, are likely to overestimate the expected vertical velocities, for the following reasons:

- The wind profile is assumed to be constant with height with no occurrence of wind-shear. In reality, there is a considerable variation with height, especially in light winds;
- Wind direction is assumed to be parallel with the line of stacks, resulting in

the maximum enhancement and merging of the plumes; and

- Worst-case scenarios are for very light wind, near neutral atmospheric conditions, with maximum loading.

Q8 *Please describe the conclusions of the study.*

A8 Based on the results listed in Table 1, for realistic wind scenarios, the average plume vertical velocities are unlikely to exceed 4.3 m/s above a height of 195 meters (640 feet). At 182 meters (approximately 600 feet), the plume velocities are not predicted to exceed 4.3 m/s for 99.80 percent of the time.

Under the worst case scenario of calm winds throughout the lower atmosphere, which the meteorological model predicts will occur only 2 hours per year, the average plume vertical velocity is estimated to achieve 4.3 m/s at a height of 309 meters (1013 feet) above ground level for the merged gas turbine plumes and 315 meters (1033 feet) above ground level for the merged cooling tower plumes.

During the worst-case scenario of uniform calm wind conditions throughout the lower atmosphere and all units operating at peak load, the average vertical velocity within the plume is predicted to be at or above the CASA threshold up to 285 to 315 meters above ground-level. The height at which the guideline is achieved is significantly reduced for greater wind speeds, with peak values of 95 meters above ground-level for cooling tower plumes and 195 meters above ground-level for gas turbine plumes.

Assuming a uniform wind profile is extremely conservative and as presented in Table 1, the introduction of realistic wind profiles reduces the height at which the guidelines are achieved by 50 to 70 percent.

Q9 *The Staff assessment discounts the use of the realistic wind scenario in the Katestone report because "Staff cannot adequately review those results without a copy of the Katestone model." Can the Katestone method be validated using an alternative method?*

A9 Yes, TAPM is a publicly available model that has been extensively validated and tested. As well as a meteorological processor, TAPM also has a sophisticated dispersion model that is coupled with the wind field model, capable of predicting the plume rise and dispersion of a range of emission sources. Consequently, TAPM can be used with a buoyancy enhancement factor as an alternative method to estimate the vertical velocity of the RCEC project. To demonstrate this, Katestone prepared a second addendum report (Exhibit 29) as an independent verification of the Katestone Method. These results are presented in Table 3.

Plume rise varies as a function of buoyancy to the power of one third, thus the maximum plume rise enhancement factor, E_N, for N stacks would be $N^{1/3}$ if all emitted buoyancy were completely conserved. For this study, a buoyancy enhancement factor of $N^{1/3}$ has been applied to reach stack in the TAPM model setup. The nine cooling tower plumes have an enhancement factor of $E_N = 2.08$ and two gas turbine scenarios used an E_N = 1.26).

The results indicate that there is generally very good agreement between the methods. The Katestone Method predicts slightly higher critical plume heights for most of the time, compared with TAPM. However, the differences are so slight as to be insignificant.

TABLE 3
Results for critical plume height for the proposed RCEC cooling towers and gas turbine scenarios and the proportion of the simulation year that the critical height is exceeded.

Percent of time	Critical Plume Heights (Meters Above Ground Level)					
	Cooling Towers		Gas Turbines Scenario 1		Gas Turbines Scenario 2	
	TAPM	**KE**	**TAPM**	**KE**	**TAPM**	**KE**
E_N	2.08	-	1.26	-	1.26	-
90	29	28	59	64	59	65
80	29	31	59	68	59	68
70	30	34	64	72	64	73
60	30	37	65	76	65	77
50	31	42	66	80	66	82
40	35	47	71	86	72	87
30	36	53	73	92	73	94
20	37	58	79	101	79	104
10	42	64	102	116	103	119
9	42	65	102	118	103	121
8	43	66	103	120	104	123
7	47	67	104	122	105	126
6	47	69	105	125	106	129
5	48	70	106	128	107	134
4	48	73	108	132	110	140
3	67	76	113	136	131	147
2	68	80	132	142	135	154
1	70	84	137	150	154	162
0.5	72	87	156	156	161	171
0.3	73	89	160	159	168	177
0.2	73	90	161	161	180	182
0.1	74	92	173	167	185	187
0.05	95	93	184	175	190	195

C. The Staff's Calm Conditions Analysis of Thermal Plumes

Q10 The SA presents a plume vertical velocity analysis conducted by the staff. Are there any errors in this analysis?

A10 Yes, there are several significant errors in the Staff's analysis and the analysis misinterprets the CASA Advisory Circular in several ways.

(1) The CASA Advisory Circular was written to provide guidance to airport operators and persons involved in the design, construction and operation of facilities with thermal exhaust plumes about the information required to assess the potential hazard from a plume rise to aircraft operations. Once a hazard assessment has been undertaken, the information can be used to manage or reduce the risk posed by a thermal exhaust plume to an aircraft during low-level flight. The Advisory Circular clearly defines a preferred method for undertaking a hazard assessment using realistic site-specific meteorological conditions. Section 8.2 of the Advisory Circular cautions that

> In the absence of reliable meteorological data, plume rise has often been assessed in the still air conditions. While this represents a worst-case scenario, the probability of this occurrence in actual weather conditions at the development site is usually quite low.

Section 8.3 continues, "Lateral dispersion may similarly have been misrepresented, because these models assume that wind conditions are constant with height." Therefore, because the RCEC project has available site-specific meteorological data (through the use of TAPM), the CASA Advisory Circular would advise the use of this data and would not rely, as Staff has done, on a still-air or calm-air assessment.

(2) The simplified Calm Condition Method (CCM) calculations used by CEC staff for merged plumes as shown on the bottom of Staff Assessment Page 4.10-27 are incorrect. When using the CCM for merged plumes, the Staff should have used the equations presented in Appendix D of the Katestone report. Additionally, the Staff incorrectly assumes that both turbine plumes merge immediately upon release during calm winds, even though the stacks are separated by 120 feet. As a result, the calculations used by the Staff are unrealistic and plume rise is overestimated.

(3) The Staff states that wind speeds of 1.0 m/s or less and temperatures less than 60ºF occur 7 percent of the time, based on seven years of Union City data. By citing this data, Staff seems to imply that calm wind conditions will occur 7 percent of the time. This is not correct. Our review of the raw Union City data, shows that ACTUAL calm winds (wind speeds equal to 0 m/s) occurred during a total of only 9 hours over a period of eight years (or 0.013 percent of the valid hours). Therefore, the vast majority of time that the Staff characterizes as "calm conditions" actually experienced light wind conditions during which the CCM is not appropriate as a technique for plume assessment.

Moreover, the Union City data is based on measurements at ground level (or 10 meters above ground level) that are likely to understate the wind speeds at plume height. A general wind speed power law can be used to estimate the vertical wind speed based on the surface winds and an exponent dependant upon the stability of the atmosphere. Calm winds are generally more likely during stable nighttime conditions. Using the wind power law and an exponent of 0.55 (typical for stable atmospheric conditions) and a wind speed of 0.2 m/s (which is at the typical threshold velocity of wind sensors) at 10 meters above ground level, the wind speeds would be 0.5 m/s at 50 meters, 0.7 m/s at 100 meters, and 1.3 m/s at 300 meters above ground level. For a 1 m/s wind speed at 10 meters, there would be a wind speed of 2.4 m/s at 50 meters at, 3.5 m/s at 100 meters and 6.5 m/s at 300 meters above ground level. As shown in the Best, et al. technical paper (cited by the Staff), even slight wind conditions can dramatically decrease the heights of plumes from a simple-cycle turbine.

(4) Staff incorrectly assumes that all wind speeds less than 1.0 m/s should be considered as if there is zero wind speed and, therefore, that all wind speeds less than 1.0 m/s will produce plume velocities that exceed the 4.3 m/s threshold at specified height. There are no calculations to support this conclusion. The staff assumption that wind speeds less than or equal to 1.0 m/s are calm is based on air quality modeling procedures that are not applicable to this type of analysis.

For air quality impact analyses, wind speeds are generally limited to a minimum of 1 m/s so that unreasonably high concentrations are not predicted (concentrations are inversely proportional to wind speed). However, current PSD monitoring guidelines clearly state that the minimum starting wind speed threshold should be used to determine hours with calm winds. The starting wind speed threshold for the Union City anemometer is 0.2 m/s. Thus, any wind speed equal to or greater than 0.2 m/s should be considered to be a valid non-calm hour.

Q11 *The SA States: "Under certain meteorological conditions (dead calm wind) and cool temperatures (38°F), the plumes would maintain significant velocity and integrity as they gain elevation." Do you agree with this statement?*

A11 In the abstract, the statement is meaningless. The statement does not define "significant velocity" nor is it specific to any particular elevation. It would be equally valid to say "under all conditions, plumes lose significant velocity and integrity as they gain elevation." Moreover, the statement fails to address the frequency or probability of occurrence of the velocities at any specified elevations.

Q12 *Do you have any other concerns about the Staff's vertical plume assessment?*

A12 Yes, we do. If the Staff wishes to apply the Australian screening threshold of 4.3 meters as a screening tool, then the Staff should also apply the **entire** assessment methodology that was designed to accompany the Australian advisory. The full assessment methodology as it is practiced in Australia requires the use of refined models such as TAPM to incorporate site-representative meteorology accurately and realistically predict the frequency of vertical plume velocities. This then allows CASA to assess the risk of the potential hazard and take suitable measures to alert pilots to avoid the hazard. Staff incorrectly rejects the refined models and the site-specific meteorology. Staff improperly focused only on the unrealistic calm wind scenario to produce an unrealistic result.

Chapter 3: Airport Operations

A. Introduction

Q1 *Please state your name, address, position and qualifications.*

A1 Marshall W. Graves, Jr.
President/CEO, International Institute for Aviation, Science and Technology
3303 California Avenue
Carmichael, CA 95608

Formal Education:
MSEME (Mechanical Engineering), University of Michigan
BSEME (Mechanical Engineering), University of Michigan

Relevant Training:
Aviation Safety Officer, U.S. Navy Postgraduate School

Flight Experience:
4000+ total hours, airplanes and helicopters

FAA Certificates:
Airline Transport Pilot (MEL)
Commercial Helicopter Pilot

Relevant Credentials:
Commander, U.S. Navy (Ret) / Career Naval Aviator
Registered Professional Engineer, Mechanical, California
Designated Aerospace Engineering Subspecialist, U.S. Navy
Joint Service Standardization Instructor Pilot, U.S. Navy

Relevant Experience:
Chief of Aviation, California Department of Forestry (Cal Fire)
Director of Operations, Naval Aviation Depot, Alameda
Executive Officer, Navy Office, Sikorsky Aircraft Company
Air Operations Officer, USS Ranger / USS Peleliu Battle Group
Mechanical Engineering Instructor, U.S. Naval Academy

Q2 *Please describe the purpose of your testimony.*

A2 The purpose of my testimony is to discuss how the RCEC will affect airport operations and safety at the Hayward Executive Airport.

B. FAA Safety Risk Analysis

Q3 *The FAA study concluded that:*

"Current regulations and advisories as well as the present Notice to Airmen (NOTAM) Temporary Flight Restrictions should preclude prudent pilots from flying through or near plumes, thereby making the aviation risk essentially zero."

Do you agree with this statement as applied to the Hayward Executive Airport if the RCEC is constructed?

A3 Yes.

Q4 Please explain why.

A4 Pilots at every certification level **are required to familiarize themselves with the notices, cautions, warnings and to comply with restrictions and prohibitions** associated with the airspace they will fly through and with the aerodromes they will operate to/from. NOTAMS and TFRs are always accessible 24/7 from Flight Service Station briefers via toll free phone access or from online computer programs located at most airports.

Also, Airport Facility Directories, Flight Guides, Airway Manuals, and Aeronautical Charts, available to all pilots, list and/or depict cautions and hazards related to the airspace in the vicinity of the airport. It would be unconscionable for pilots to ignore warnings, cautions or advisories pertaining to their flights.

Q5 The SA states:

"Although the FAA statistical analysis determined the risk of thermal plumes to be acceptably low, given the particular circumstances in Hayward, staff believes the RCEC plumes could be a substantial hazard to aircraft flying overhead at low altitudes within the transition zone."

Do you agree with this statement?

A5 No. The FAA study was conducted by 11 FAA subject matter experts under the auspices of the Flight Procedures Standards Branch, Flight Technologies and Procedures Division. These experts represented various disciplines including aviation safety, risk analysis/assessment, human factors, aeronautical engineering, air traffic control, statistical analysis, and military/civil and commercial aviation operations. The methodology used was the FAA Safety Risk Management process contained in the FAA Safety Management System. It is a rigorous process that exhaustively examines:

- Description of presumed safety issues
- Identification of potential hazards
- Risk analysis
- Risk assessment
- Mitigation of risk

As part of the risk analysis/assessment, the team ***studied*** 30 years (1975-2004) of General Aviation aircraft accident data representing more than **849 million flight**

hours. During this time period **not one single accident or incident could be contributed to overflight of a thermal industrial plume.**

In the summary of the risk analysis the team concluded:

> Given the virtually non-existent accident/incident safety data by either GA or commercial aviation pilots, the team was extremely confident in drawing the preliminary inference that hazard(s) associated with plume overflight represent an **extremely low risk to aviation** and the flying public.

C. Airport Operations

Q6 The SA indicates that air traffic around the Hayward Municipal Facility will often encounter the RCEC. Would this be a frequent occurrence?

A6 If the RCEC is constructed, aircraft will not fly overhead of the facility. Aircraft operating under Instrument Meteorological Conditions (IMC) within the Hayward Executive Airport airspace will be under positive control, adhering to mandatory flight paths and altitudes. All instrument approaches to the Hayward Executive Airport commence at locations well to the southeast of the airport at a minimum altitude of at least 3500 feet MSL. From there the aircraft follows a very narrowly defined horizontal path at specific altitudes that would never place an aircraft within the vicinity of the RCEC site. See Instrument Approach for the LOC/DME Runway 28L, included as Attachment 9 to this testimony. Once the pilot has commenced the approach he/she may initiate a missed approach at any time, all of which require an immediate climb to 2000 MSL on a path directly to the Oakland VORTAC. This procedure also precludes the aircraft from being anywhere near the RCEC site.

Please note also that instrument approaches to Runway 10R or Runway 10L are only authorized by first flying an approach to either Runway 28L or 28R and then circling within the runway environment to land on runway 10R or Runway 10L.

Instrument Departures may vary as approved by Oakland Center. However, standard instrument departures for the Hayward Executive Airport are:

- Runways 28L/28R: Climb straight ahead to the approved initial altitude.
- Runways 10R/10L: Northwest bound, climbing right hand turn to 2500 feet MSL direct to the Oakland VORTAC. Southeast bound, climb straight ahead to 4500 feet MSL and proceed to the MABRY intersection.

Likewise, these procedures preclude the aircraft from being anywhere near the RCEC site.

To operate under Visual Meteorological Conditions (VMC) within the Hayward Executive Airport airspace, horizontal visibility must be at least 3 statute miles as defined by the controlling agency (Hayward Tower). All aircraft including helicopters must maintain radio communications with the Tower during tower operations (0700 to 2100 local time) and comply with all instructions from tower personnel. Special Visual Flight Rules (VFR) may apply to helicopters, but only if authorized by the control tower and with the requirement to see and avoid all other aircraft and obstructions.

Airplane VFR traffic would typically remain within the approved traffic patterns (far away from the RCEC site) unless arriving to or departing from the airport traffic pattern. To do so, the aircraft would not be at the traffic pattern altitudes of 600 to 800 feet AGL but would comply with airport requirements to transit between 1200 to 1400 feet MSL, which is well above any expected vertical reach of the RCEC plume, even under the worst case condition (no wind).

Other obstacles (radio towers) to the west and southwest of the runways exist within the Hayward Executive Airport airspace. These are depicted on aeronautical charts and Instrument Approach Procedures (see RWY 28L) with the highest being depicted at 234 feet MSL. FAA altitude restrictions in uncongested areas (the RCEC site is technically considered to be located in an uncongested area, but it is on the fringe of a congested area) require pilots to fly at least 500 feet above ground level (AGL) and to avoid all obstacles laterally by at least 500 feet. Helicopters in controlled airspace may operate below these limits, ***if approved***, but must not conduct operations hazardous to persons or property.

The SA references a data set, *April 2007 Flight Tracks over Russell City and Eastshore Energy Centers Sites*, provided by Robert Bauman, Director of Public Works, City of Hayward. For this month nearly 10,000 operations (flight tracks) were analyzed to determine how many flights passed within range of the proposed RCEC site and one other proposed project. The computer program which analyzed the flight paths over the ground identified 42 such aircraft which flew through a virtual "gate" with a width of 300 meters (984 feet) and a height of 1,000 feet centered on the RCEC site. The frequency of occurrence for this event was on the order of 0.40 percent of all operations within the Hayward Executive Airport airspace. The City's study of the patterns found that:

> Particularly for RCEC if we had set the height at 800 feet we would have gotten very few flights recorded through the gate. You will note that with few exceptions, most being helicopters, all flights passed at over 600 ft as expected (electronic mail from Bob Bauman, Director of Public Works, City of Hayward, to Jim Adams, California Energy Commission, May 8, 2008).

In other words, most of the flights over RCEC were between 800 and 1,000 feet and almost all were above 600 feet, and there were few flights passing through the RCEC "gate." The SA nevertheless concludes the frequency of this occurrence is significant.

However, this is a specious argument. No powerplants exist at the geographic portals used to identify these 42 flights. If the RCEC facility were constructed and NOTAMS / TFRs, chart depictions, etc., warn pilots of the location and direct flights to avoid the area, no overflights would occur at any altitude within the Hayward Executive Airport airspace. To assert that aircraft need to fly in this area at least 40 times a month has no substantive basis.

Consequently, for VFR operations, "see and avoid" doctrine and compliance with altitude and lateral separation restrictions preclude an aircraft from being affected by plumes, especially if NOTAMS, TFRs, chart depictions, etc., alert the pilot to the presence of the RCEC facility with appropriate cautions/warnings to avoid flight in the vicinity.

Q7 *The SA states:*

"Normal traffic pattern elevation is 600 to 800 feet AGL which provides sufficient separation from Oakland Airport controlled airspace beginning at 1,450 feet AGL (Hayward Executive Airport 2007)."

Is this correct in the vicinity of the RCEC site?

A7 No. The RCEC site is not within the boundaries of the traffic pattern of Hayward Executive Airport.

Q8 *The SA states that 400 feet "is an elevation used by helicopters and aircraft executing a missed approach from RY 10R/28L." Is this true?*

A8 No. First, there are no authorized instrument approaches directly to RWY 10R. All approaches must be conducted first to RWY 28L/R, after which a circling approach within the runway environment can be conducted to RWY 10R/L. Second, all missed approach procedures for all approved approaches require an immediate climb to 2,000 feet MSL on a path directly to the Oakland VORTAC.

Q9 *The SA states, "Although the thermal plume danger conditions are low, staff believes the RCEC plumes could pose a significant risk and hazard to pilots because they would occur in a constrained airspace that frequently requires pilots to maneuver at low altitudes." Do you agree?*

A9 No. First, the airspace in the vicinity of the RCEC site is not constrained and provides transiting aircraft sufficient vertical separation from the surface, obstacles and the floor of the Oakland Airport airspace lying above the Hayward Executive Airport airspace. Second, aircraft are never required to maneuver at low altitude. Intentional maneuvering at low altitude (neither defined by the SA) away from a runway environment could be construed by the FAA as reckless and an endangerment to the life and property of others.

Q10 *Citing Blythe, the SA states that, "staff is concerned that aircraft could experience similar turbulence when flying over the RCEC at routine traffic pattern elevations." Do you agree with Staff's concern?*

A10 No. Pilots will not fly over the RCEC site or adjacent to the KFAX towers at routine traffic pattern elevations or at any altitude within the Hayward Executive Airport airspace. They will avoid overflights entirely.

Q11 *The SA states, "Therefore, the recommendation in the 2006 FAA Safety risk analysis (noted earlier) that aircraft stay above 1,000 feet AGL when flying over plume generating industrial facilities is not feasible in this case, because pilots want greater separation from Oakland Center controlled airspace. It is important to reiterate the fact that the traffic pattern in the Hayward Airport area is 600 to 800 feet AGL, and even lower for helicopters." Do you agree?*

A11 No. While the traffic pattern in the Hayward Executive Airport area may be 600 to 800 feet AGL, that is not the transit altitude over the RCEC site, which is 1,200 feet to 1,400 feet AGL (per tower requirements). No data is offered in the SA substantiating the claim that pilots desire greater vertical separation from the overlying Oakland Airport airspace and therefore desire to fly at Hayward Executive Airport traffic pattern altitudes while transiting through the Hayward Executive Airport airspace. The vertical separation already available and required is more than adequate to ensure traffic separation between aircraft within both the Oakland Airport and Hayward Executive Airport airspaces

D. Thermal Plumes and Aircraft Safety

Q12 *The SA quotes the Blythe decision: "Under worst-case conditions (solo pilot, small plane, flying at or below approach altitude, cool winter night or early morning with little or no wind, power plant at full-load), unexpected severe turbulence can cause sudden and significant aircraft position changes (such as 90 degree rolls to the left or right). High angle turns at low speed will result in a loss of aircraft lift and altitude. In addition, sudden aircraft position changes at night can result in pilot vertigo – the loss of reference to the earth's horizon. This can result in pilots' (sic) losing their sense of what is up and what is down. At night, this can easily lead to an aircraft accident. This problem is exacerbated if the pilot is inexperienced or the aircraft is experiencing emergency conditions. (Blythe Energy Project Phase II, Commission Decision, December 2005, pg. 178)." Please comment on this statement.*

A12 The Commission is correct that sudden turbulence from any source can impact aircraft. But, with the benefit of the FAA Study, it is not correct to say that turbulence from a power plant's thermal plume can, at night, "easily" lead to an aircraft accident. The FAA has no reported record any such incident or accident and forecasts the odds of such an incident to be less than one (1) in a billion.

The FAA study did determine that any risk, ***if it exists at all***, (which they do not conclude exists), would only be to aircraft in the takeoff and approach/landing phase of flight. These flight regimes would only occur in close or immediate proximity to the actual runway environment, far away from the RCEC site. Also, only aircraft (airplanes) less than 12,500 pounds and those in Light Sport Aircraft (LSA) categories, would be of concern.

However, *for the sake of argument only*, let's examine the effects of a sudden, unexpected encounter of turbulence from the predicted RCEC thermal plume by an airplane or helicopter. Two factors are relevant: (1) airplane stall margin from upset and (2) gust loads on both airplane and helicopter structures and aerodynamic surfaces.

For the purposes of illustration, a Cessna 172N, which is representative of a typical small airplane, is chosen for analysis. Two flight conditions were considered: (1) power-on flights at 115 knots (cruise) and (2) 70 knots in a clean configuration (no flaps). These configurations are the limits of flight that would be expected in the area of the RCEC site. Power-off flight, consistent with an anticipated descent to traffic pattern altitude, would not be initiated until much closer to the Hayward Executive Airport.

The ability of an airplane's wing to provide lift is determined by the angle of incidence the wing has with the wind relative to the wing. This is called the angle of attack. As the angle of attack is increased (usually by an increase in nose attitude for level flight) the wing will generate greater lift until such time as the angle becomes so great that the airflow over the wing can no longer follow the contour of the upper wing surface and separates at the leading edge of the wing. This flow separation causes a dramatic loss of lift and the wing (airplane) stalls.

For the Cessna 172N, power-on level flight at 115 knots occurs at a pitch attitude (nose up or down) of approximately 1^{o} nose up, dependent upon aircraft weight and load distribution in the cabin. The critical upward thermal plume velocity for the RCEC emission is set, for assessment purposes, at an average of 4.3 meters per second or 14.1 feet per second. Adding this upward vertical component of "wind" to the forward relative wind of 115 knots (194 feet per second) results in an instantaneous increase in angle of attack of approximately 4.1^{o}. A power-on stall for the Cessna 172 occurs at very high angles of attack, near 25^{o} to 30^{o} nose up. Thus the stall margin would only be reduced by 4^{o}, to 20^{o} to 25^{o} of additional nose up pitch available. This is an insignificant amount.

For the 70 knot (117 feet per second), level flight configuration (approximately 2^{o} to 3^{o} nose up), adding the same upward vertical component of "wind" from the plume to the horizontal velocity results in an instantaneous increase in angle of attack of 7^{o}, still well below the onset of stall.

Both of these analyses are predicated upon encountering an immediate wind shear effect, which is extremely unlikely since the plume will have velocities at the outer edge of the plume boundary significantly dissipated from the core (center) velocity. Consequently, flight by a small airplane directly into a plume will have negligible effect on the stall characteristics of the aircraft.

In consideration of gust loads on the airplane's aerodynamic surfaces and structures, small airplanes are certified under FAA Part 23 requirements. In particular, §23.331, §23.333(c), and §23.341 require airplanes to accommodate vertical gusts of ± 50 feet per second in shear loads at cruise speeds, and ± 25 feet per second at maximum speeds in a dive (1.1 times the maximum speed authorized for level flight).

The level of turbulence that aircraft could encounter from the RCEC is, moreover, a comparatively low level of turbulence. Aviation turbulence is stated terms of vertical gusts and wind shears. The standard categories of turbulence are (*Aviation Weather*, Peter F. Lester, Third Edition, 2007):

Light	300-1,199 feet per minute
Moderate	1,200-2,099 feet per minute
Severe	2,100-2,999 feet per minute
Extreme	3,000+ feet per minute

Typical thermal plumes from the heating of dry land on a warm day routinely generate upward gusts of 200-400 feet per minute. A typical PIREP (Pilot Report) or AIRMET (Airmen's Meteorological Information) would categorize expected turbulence in the RCEC project area as Light to Moderate. All pilots encounter these kinds of updrafts on a routine basis. In comparison, a thermal plume from the RCEC facility at 4.3 m/s (14 feet per second) would be classed as light turbulence, at 840 feet per minute. As the plume modeling analysis in Chapter 2 has shown, thermal plumes from the RCEC even at this velocity would very rarely occur at the altitudes at which aircraft are at all likely to fly.

Therefore, even the worst-case RCEC thermal plumes would be at the low end of the spectrum of turbulent updrafts that pilots routinely experience. The FAA considers an acceptable response to control inputs from encounters with turbulence (within the limits of aircraft certification requirements) to be within the capability of pilots at any skill level.

Thus, a small airplane encountering a thermal plume from the RCEC facility, even at maximum shear conditions, would experience no adverse effect other than a momentary disruption to stabilized flight, which would be well within the design limits of the aircraft and well within the capability of a pilot at any skill level to control.

A helicopter main rotor system is designed to maintain controllability with steady state updrafts through the rotor system approaching 3,000 feet per minute (~ 50 feet per second) such as those experienced during autorotations. This flight regime can be initiated from powered flight as an immediate response to a complete loss of all engine power or loss of lift from the tail rotor. Encountering a "gust' from the RCEC plume would be well within the capability of a helicopter pilot at any skill level to provide control input to stabilize the helicopter. No flight risk would result.

Helicopters (rotorcraft) in both the Normal and Transport Category are certified to withstand instantaneous gust loads of ±30 feet per second on rotor and aerodynamic surfaces. This is valid for all flight regimes from hover through maximum diving speed (1.1 times the maximum speed authorized for level flight). Part 27, §27.341 and Part 29, §29.341 apply, respectively.

In conclusion, for both small airplanes and helicopters, even encounters with a predicted RCEC thermal plume at the maximum wind shear limits (essentially impossible) present no hazard to flight. The response of the aircraft would be a minor disruption or upset to stabilized flight which is well within the capability of a pilot at any skill level to control and is well within the certified design limits (gust loads) of the aircraft.

To quote the FAA Safety Risk Analysis:

> Safety is freedom from unacceptable risk. Everyday in the NAS aircraft and airmen operate with hazards that constantly present various levels of risk. From bird strikes, to engine failures, to runway incursions, these situations present vastly different scenarios for the pilot, crew, and ATC personnel to consider. However, these hazards all have one characteristic in common – they represent ***acceptable risk*** that is considered and mitigated as necessary to allow flight operations to proceed to a safe conclusion in the vast majority of cases. Many of **these risks represent far greater concern** and thereby require a more complicated Risk Control Strategy or mitigation effort **than the issue addressed by this study.**

Our interpretation of available data is not so much that industrial thermal plumes are not hazards or present zero risk, but that pilots and controllers operating within the NAS have been and will continue to apply prudence and common sense skills to constantly "see and avoid" any potential hazard. These mitigating techniques are employed everyday throughout NAS through timely communication, training, and procedures for operating near hazardous weather, forest fires, large sporting events, volcanic ash, migratory bird activity, antenna towers and overhead wires."

Attachments

1 Forms 7460-1 for the RCEC Exhaust Stacks

2 FAA Determinations of No Hazard for RCEC Exhaust Stacks

3 FAA Notice to Airmen FDC 4/0811, October 8, 2003

4 Electronic mail from Peter Soderquist, Director, Southern California Logistics Airport to Douglas Davy, July 11, 2007

5 Letter from Jesús Armas, City Manager, City of Hayward Manager to Shaelyn Strattan, California Energy Commission, June 27, 2007, with map showing Hayward Executive Airport Master Plan Exhibit 5B

6 Figure 3-8, Compatibility Factors, draft Alameda County Compatibility Land Use Plan, July 2007

7 Table 2-2, Safety Zone Compatibility Summary, draft Alameda County Compatibility Land Use Plan, July 2007

8 Electronic mail from Dennis O'Leary, Manager, Communications and Marketing, Civil Aviation Safety Authority, Australia to Douglas Davy, May 13, 2007

9 Instrument Approach for the LOC/DME Runway 28L at Hayward Executive Airport

Attachment 1

FAA Forms 7460-1

Notice of Proposed Construction or Alteration (7460-1)

Project Name: RUSSE-000061288-07	**Sponsor:** Russell City Energy Center

Details for Case : RCEC HRSG Exhaust Stacks

Show Project Summary

Case Status

ASN:	2007-AWP-1245-OE	**Date Accepted:**	03/07/2007
Status:	Work In Progress	**Date Determined:**	
		Letters:	None

Construction / Alteration Information

Notice Of:	Construction
Duration:	Permanent
***if Temporary* :**	Months: Days:
Work Schedule - Start:	04/01/2008
Work Schedule - End:	04/01/2010
State Filing:	

Structure Summary

Structure Name:	RCEC HRSG Exhaust Stacks
Structure Type:	Stack
***Other* :**	
FCC Number:	
Prior ASN:	

Structure Details

Latitude:	37° 38' 2.41'' N
Longitude:	122° 8' 0.52'' W
Horizontal Datum:	NAD83
Site Elevation (SE):	10 (nearest foot)
Structure Height (AGL):	145 (nearest foot)
Marking/Lighting:	None
***Other* :**	
Nearest City:	Hayward
Nearest State:	California
Traverseway:	No Traverseway
Description of Location:	Site is located in Hayward, California, approximately 1300 feet southwest of the intersection of Cabot Road and Depot Road. Two exhaust stacks are located adjacent to one another.
Description of Proposal:	RCEC is a 600-MW power plant, proposed to be constructed 1300 feet southwest of the corner of Cabot Road and Depot Road in the City of Hayward in Alameda County.

Common Frequency Bands

Low Freq	High Freq	Freq Unit	ERP	ERP Unit

Specific Frequencies

Notice of Proposed Construction or Alteration (7460-1)

Project Name: RUSSE-000061288-07	**Sponsor:** Russell City Energy Center

Details for Case : RCEC HRSG Exhaust Stacks

Show Project Summary

Case Status

ASN:	2007-AWP-1246-OE	**Date Accepted:**	03/07/2007
Status:	Work In Progress	**Date Determined:**	
		Letters:	None

Construction / Alteration Information

Notice Of:	Construction
Duration:	Permanent
if Temporary **:**	Months: Days:
Work Schedule - Start:	04/01/2008
Work Schedule - End:	04/01/2010
State Filing:	

Structure Summary

Structure Name:	RCEC HRSG Exhaust Stacks
Structure Type:	Stack
Other **:**	
FCC Number:	
Prior ASN:	

Structure Details

Latitude:	37° 38' 2.39'' N
Longitude:	122° 8' 2.01'' W
Horizontal Datum:	NAD83
Site Elevation (SE):	10 (nearest foot)
Structure Height (AGL):	145 (nearest foot)
Marking/Lighting:	None
Other **:**	
Nearest City:	Hayward
Nearest State:	California
Traverseway:	No Traverseway
Description of Location:	Site is located in Hayward, California, approximately 1300 feet southwest of the intersection of Cabot Road and Depot Road. Two exhaust stacks are located adjacent to one another.
Description of Proposal:	The Russell City Energy Center is a 600-megawatt (MW) power plant, proposed to be constructed 1300 feet southwest of the corner of Cabot Road and Depot Road in the City of Hayward in Alameda County.

Common Frequency Bands

Low Freq	High Freq	Freq Unit	ERP	ERP Unit

Specific Frequencies

Attachment 2

FAA Determinations of No Hazard

Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Blvd.
Fort Worth, TX 76137-0520

Aeronautical Study No.
2007-AWP-1245-OE

Issued Date: 03/26/2007

Michael Hatfield
Russell City Energy Center
3862 Depot Road
Hayward, CA 94545

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has completed an aeronautical study under the provisions of 49 U.S.C., Section 44718 and, if applicable, Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Stack
Location:	Hayward, CA
Latitude:	37-38-2.41 N NAD 83
Longitude:	122-8-.52 W
Heights:	145 feet above ground level (AGL)
	155 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory Circular 70/7460-1 K Change 2.

This determination expires on 09/26/2008 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

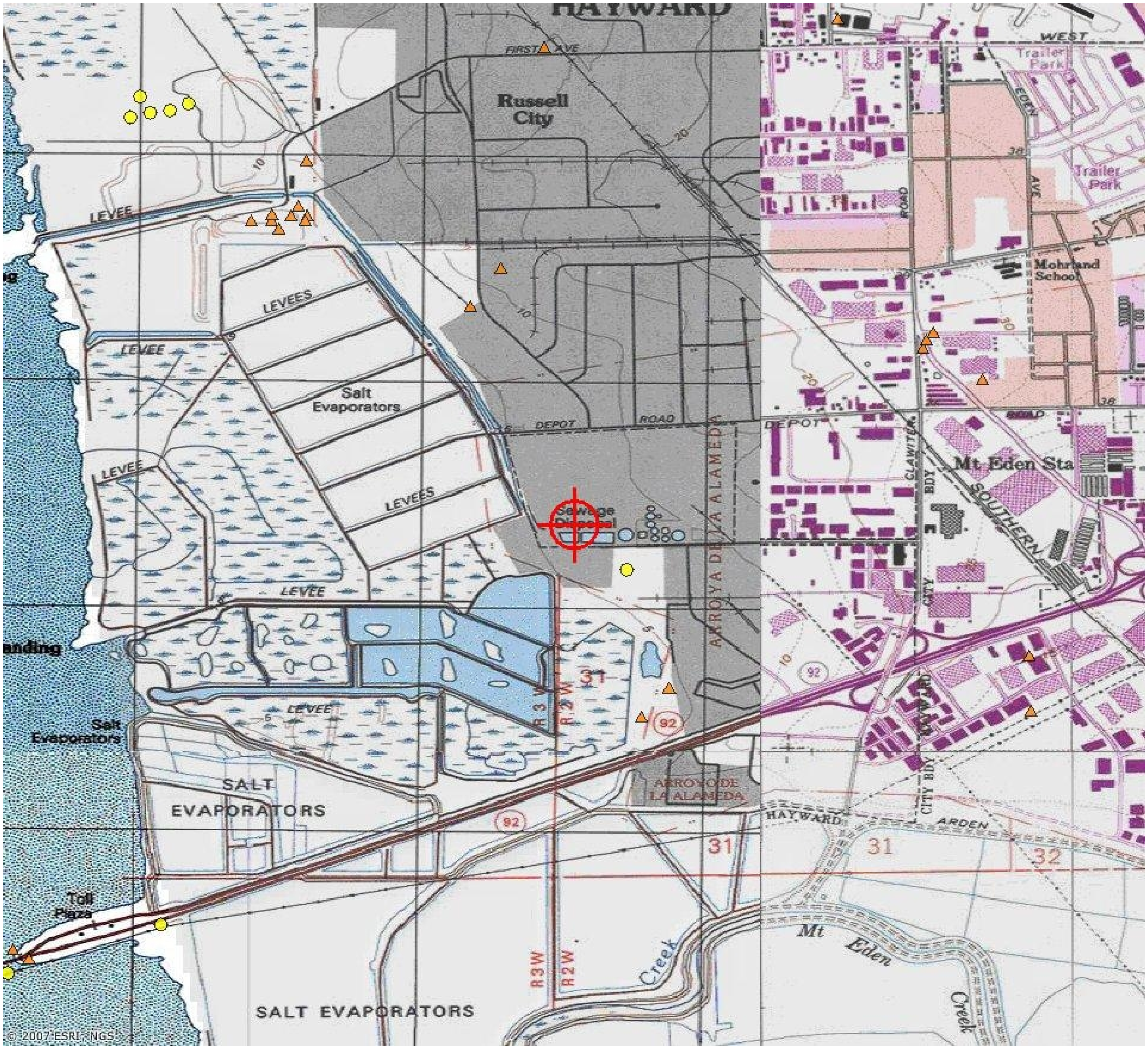
If we can be of further assistance, please contact our office at (310)725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2007-AWP-1245-OE.

Signature Control No: 506788-539800 (DNE)

Karen McDonald
Specialist

Map

Map for ASN 2007-AWP-1245-OE



Federal Aviation Administration
Air Traffic Airspace Branch, ASW-520
2601 Meacham Blvd.
Fort Worth, TX 76137-0520

Aeronautical Study No.
2007-AWP-1246-OE

Issued Date: 03/26/2007

Michael Hatfield
Russell City Energy Center
3862 Depot Road
Hayward, CA 94545

**** DETERMINATION OF NO HAZARD TO AIR NAVIGATION ****

The Federal Aviation Administration has completed an aeronautical study under the provisions of 49 U.S.C., Section 44718 and, if applicable, Title 14 of the Code of Federal Regulations, part 77, concerning:

Structure:	Stack
Location:	Hayward, CA
Latitude:	37-38-2.39 N NAD 83
Longitude:	122-8-2.01 W
Heights:	145 feet above ground level (AGL)
	155 feet above mean sea level (AMSL)

This aeronautical study revealed that the structure does not exceed obstruction standards and would not be a hazard to air navigation provided the following condition(s), if any, is(are) met:

Based on this evaluation, marking and lighting are not necessary for aviation safety. However, if marking and/or lighting are accomplished on a voluntary basis, we recommend it be installed and maintained in accordance with FAA Advisory Circular 70/7460-1 K Change 2.

This determination expires on 09/26/2008 unless:

(a) extended, revised or terminated by the issuing office.
(b) the construction is subject to the licensing authority of the Federal Communications Commission (FCC) and an application for a construction permit has been filed, as required by the FCC, within 6 months of the date of this determination. In such case, the determination expires on the date prescribed by the FCC for completion of construction, or the date the FCC denies the application.

NOTE: REQUEST FOR EXTENSION OF THE EFFECTIVE PERIOD OF THIS DETERMINATION MUST BE POSTMARKED OR DELIVERED TO THIS OFFICE AT LEAST 15 DAYS PRIOR TO THE EXPIRATION DATE.

This determination is based, in part, on the foregoing description which includes specific coordinates, heights, frequency(ies) and power. Any changes in coordinates, heights, and frequencies or use of greater power will void this determination. Any future construction or alteration, including increase to heights, power, or the addition of other transmitters, requires separate notice to the FAA.

This determination does include temporary construction equipment such as cranes, derricks, etc., which may be used during actual construction of the structure. However, this equipment shall not exceed the overall heights as indicated above. Equipment which has a height greater than the studied structure requires separate notice to the FAA.

This determination concerns the effect of this structure on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

A copy of this determination will be forwarded to the Federal Communications Commission if the structure is subject to their licensing authority.

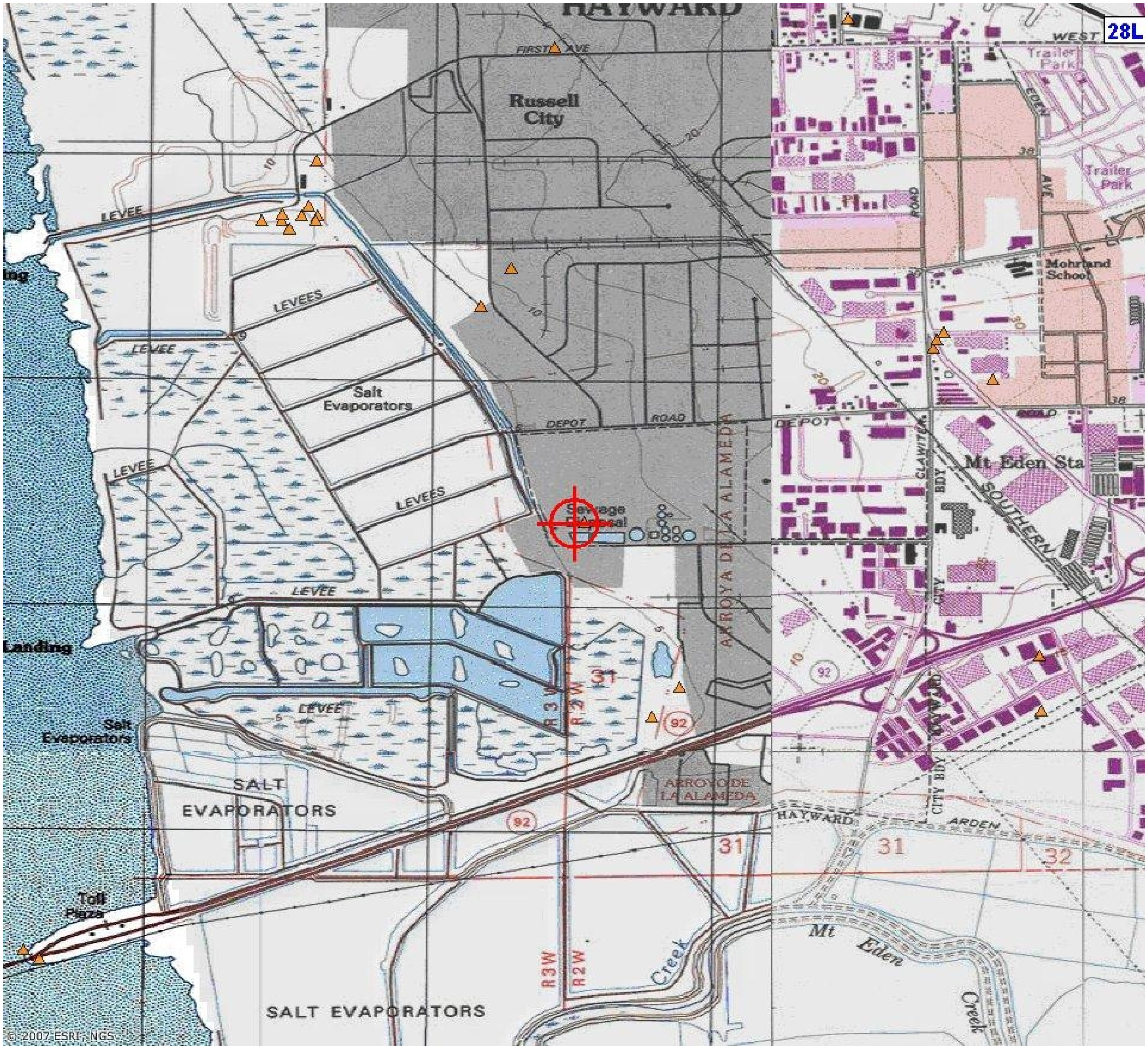
If we can be of further assistance, please contact our office at (310)725-6557. On any future correspondence concerning this matter, please refer to Aeronautical Study Number 2007-AWP-1246-OE.

Signature Control No: 506789-539804 (DNE)

Karen McDonald
Specialist

Map

Map for ASN 2007-AWP-1246-OE



Attachment 3

FAA Notice to Airmen FDC 4/0811

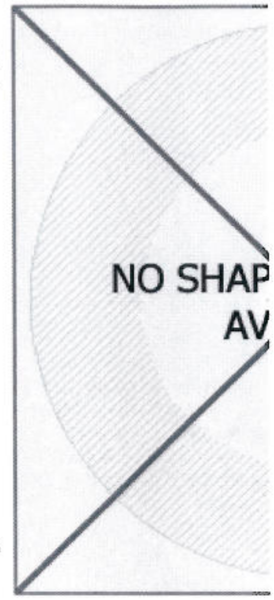
NOTAM Number : FDC 4/0811

Issue Date : October 08, 2004 at 1822 UTC

Type : Special

Plain Language text is not available for this NOTAM. The traditional NOTAM text is given below:

FDC 4/0811 FDC ...SPECIAL NOTICE... THIS IS A RESTATEMENT OF A PREVIOUSLY ISSUED ADVISORY NOTICE. IN THE INTEREST OF NATIONAL SECURITY AND TO THE EXTENT PRACTICABLE,PILOTS ARE STRONGLY ADVISED TO AVOID THE AIRSPACE ABOVE, OR INPROXIMITY TO SUCH SITES AS POWER PLANTS (NUCLEAR, HYDRO-ELECTRIC, ORCOAL), DAMS, REFINERIES, INDUSTRIAL COMPLEXES, MILITARY FACILITIESAND OTHER SIMILAR FACILITIES. PILOTS SHOULD NOT CIRCLE AS TO LOITERIN THE VICINITY OVER THESE TYPES OF FACILITIES.



Other Information:

ARTCC:

Top

Clic
Clicl
NOT

Depicted TFR data may not be a complete listing. Pilots should not use the information on this website for flight planning purpos call your local Flight Service Station at 1-800-WX-BRIEF.

Attachment 4

E-mail re: the Southern California Logistics Airport

From: Peter Soderquist [PSoderquist@CI.VICTORVILLE.CA.US]
Sent: July 11, 2007 8:27 AM
To: Davy, Doug/SAC
Subject: High Desert Power Project at KVCV
Doug

I have been the Director of the Southern California Logistics Airport in Victorville California since 2000. The High Desert Power Plant was constructed in 2002.

In response to your query, I have not received any complaints from aircraft because of thermal updrafts caused by the High Desert Power Plant.

Peter Soderquist, Director
Southern California Logistics Airport

Attachment 5

Letter from City of Hayward Regarding HMC 10-6.20

CITY OF

HAYWARD

HEART OF THE BAY

June 27, 2007

Shaelyn Stratten, Planner II
California Energy Commission
1516 Ninth Street, MS 40
Sacramento, CA 95814-5512

Dear Ms Stratten:

Earlier this month, you wrote the City asking for information about the application of the Airport Approach Zoning Regulations as it pertains to the Russell City Energy Center.

It appears that CEC is relying on these regulations as a basis for finding that RCEC is inconsistent with local Laws, Ordinances, Regulations, Standards (LORS) because of the conclusion that heat plumes generated by the plant would "endanger the landing, take off or maneuvering of aircraft." Separate from the technical issues associated with the actual plume analysis, I would like to address the issue of how Hayward's Airport Approach zoning regulations would be applied by the City.

Hayward Municipal Code Section 10-6.20, "Airport Zones," references a map designated as "The Airport Approach Zoning Plan for Hayward Air Terminal, Hayward, Alameda County, California" as establishing the basis for Section 10-6.35, "Use Restrictions." That map was adopted in 1963 and included a turning zone area that consisted of a circle with an 11,000 foot radius. The RCEC is within that radius. However, an understanding of what changes have occurred at the airport since that time is critical in understanding how that turning zone was established.

The 1963 map was based on the Airport Master Plan of 1962. At that time, as shown on the map, the Hayward Airfield had a cross wind runway at the north end of the airfield that was still in use which would have dictated the 11,000 foot circular turning zone. An early map from 1953 shows a third runway and indicates the 11,000 feet was based on Air National Guard requirements. Over the years, the City has prepared and adopted various master plans to guide aviation activity at the airport. Both the City's adopted 1984 Airport Master Plan and, more importantly, the adopted 2002 Airport Master Plan no longer include a cross wind runway and clearly show a different map now titled "California Land Use Safety Zones" (copy attached). That map shows an oval "Traffic Pattern Zone" consistent with the use of the runways as well as the Caltrans Division of Aeronautics Airport Land Use Planning Handbook and the draft update to the Airport Land Use Plan of the Alameda Land Use Commission. Hayward's Airport Master Plan and the ALUC 1986 Policy Plan use the present terminology of Safety Zones rather than what was listed in the 1964 Ordinance. Using the correct map that relates to airport safety zones shows the RCEC is 700 feet outside the Traffic Pattern Zone.

OFFICE OF THE CITY MANAGER

777 B STREET, HAYWARD, CA 94541-5007
TEL: 510/583-4300 • FAX: 510/583-3601 • TDD: 510/247-3340

This is consistent also with the very low number of aircraft that have been shown to actually fly over the plumes, 0.4% or less of annual operations.

Based on the foregoing it has been determined that the location of the RCEC is not inconsistent with application of our ordinance, as described above. At the same time, City staff have consistently indicated and agreed that measures such as a posted NOTAMS would also be prudent.

I trust you will find this information helpful in completing your staff analysis. Should you have questions or need clarification, feel free to contact me by email at Jesusa@hayward-ca.gov or by telephone at 510.583.4305.

Very truly yours,

Jesús Armas
City Manager

Attachment

97MP17-5B-10/15/99

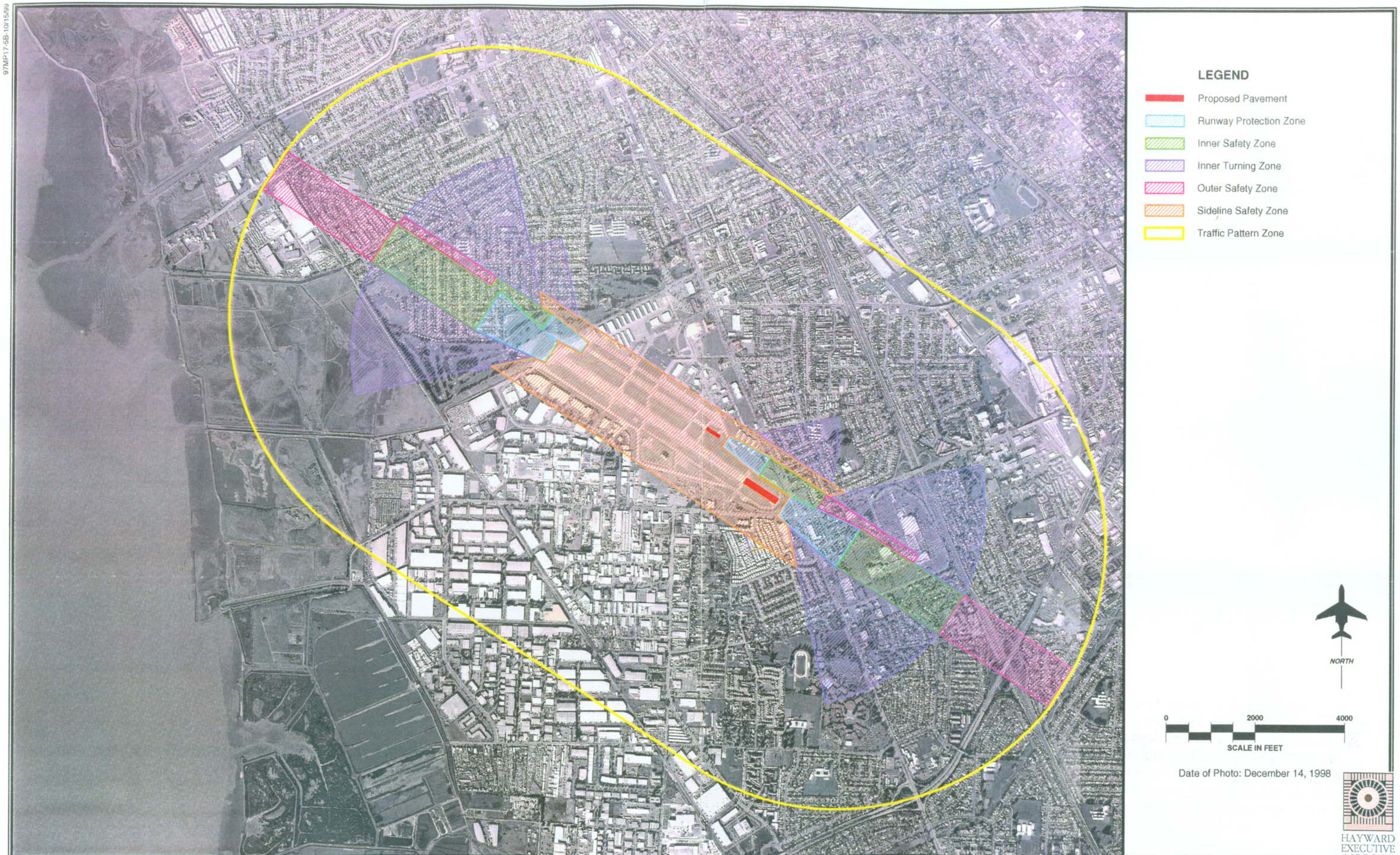
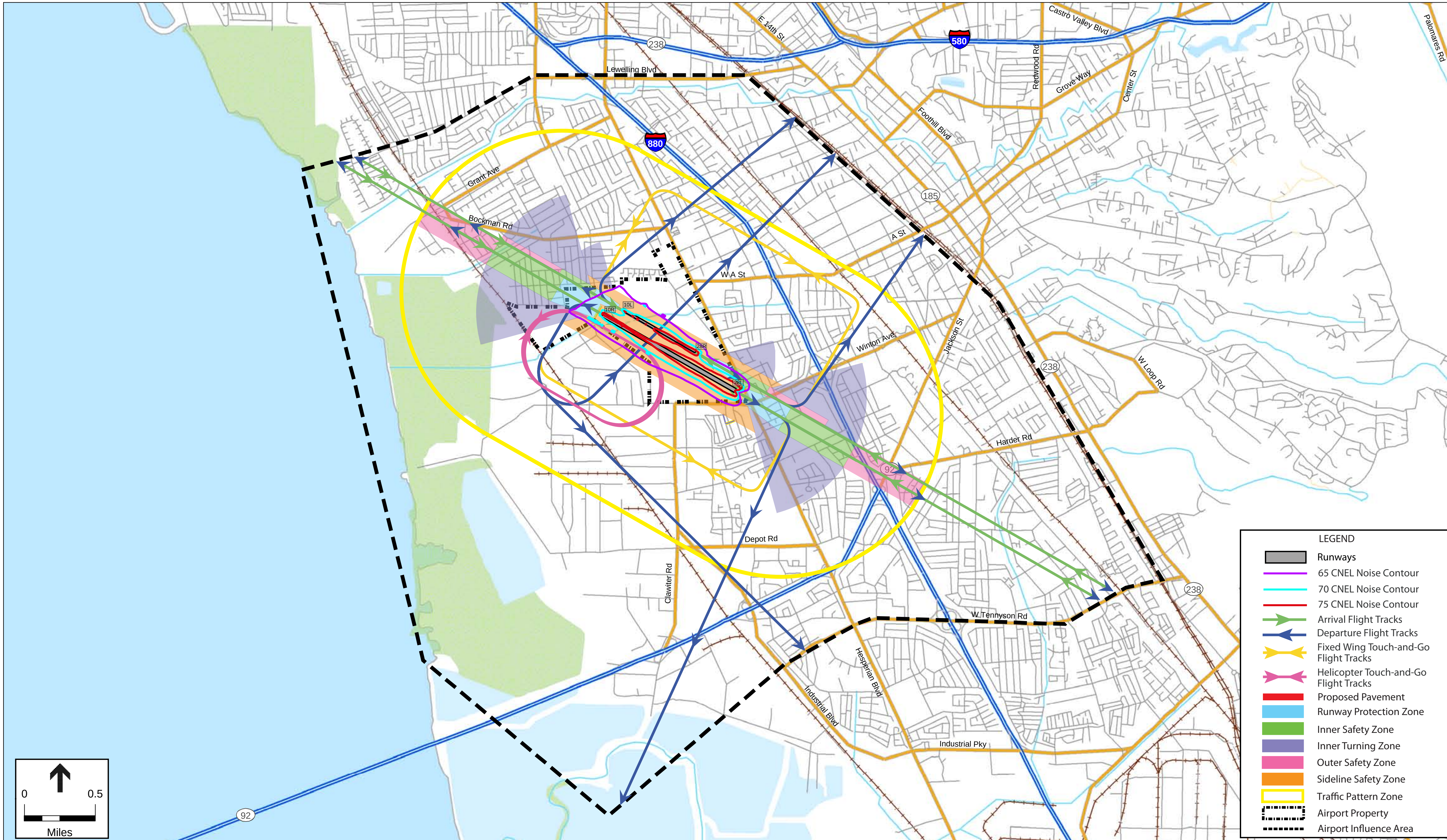


Exhibit 5B
CALIFORNIA LAND USE SAFETY ZONES

Attachment 6

Figure 3-8, from the draft HWD CLUP



SOURCE: ESA Airports, ESRI, City of Hayward GIS Department

Figure 3-8
Compatibility Factors

Attachment 7

Table 2-2, from the draft HWD CLUP

TABLE 2-2
SAFETY ZONE COMPATIBILTY SUMMARY (CONT.)

	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6
Utilities						
Roadways	C	C	O	O	O	O
Reservoirs	C	C	O	O	O	O
Water Treatment	C	C	O	O	O	O
Sewage Disposal	C	C	O	O	O	O
Petroleum and Chemical Products – Bulk Storage	C	C	C	O	O	O
Electrical Plants	X	X	C	O	O	O
Power Lines	C	C	C	O	O	O
X – Prohibited O – Compatible C – Conditionally Approvable						

Zone 1: Runway Protection Zone
Zone 2: Inner Approach / Departure Zone
Zone 3: Inner Turning Zone
Zone 4: Outer Approach / Departure Zone
Zone 5: Sideline Zone
Zone 6: Traffic Pattern Zone

Attachment 8

E-mail from Civil Aviation Safety Authority, Australia

From: O'LEARY, DENNIS [mailto:DENNIS.O'LEARY@casa.gov.au]
Sent: May 13, 2007 4:19 PM
To: Davy, Doug/SAC
Subject: RE: Aviation safety and industrial thermal plumes [SEC=UNCLASSIFIED]

Hi Douglas

I've spoken to our people in the standards area who gave me the following in response to your question.

"Whilst damage to the airframe is a concern, our main concern with a gust of efflux from a power plant is that it may destabilise an aircraft in flight, leading to loss of controllability, particularly if the impact of the efflux is asymmetric, impacting on one side of the aircraft wing. The origin of the 4.3 m/s trigger for plume rise assessment is somewhat loss in antiquity, but the value of 4.3 m/s efflux impacting on the navigable airspace (based on 110m above ground level) means that in general, only industrial plant with significant discharge are affected.

The plume assessment aims to determine, based on scientific analysis of the characteristics of the plume, the magnitude and the extent, both vertically and horizontally, of the impact of the plume, and the frequency of occurrence. This information allows CASA to assess whether pilots need to be specifically warned and if deemed necessary, declare a block of airspace as a danger area from which pilots are advised not to traverse."

I hope this helps.

Regards

Dennis

Dennis O'Leary
Manager
Communications & Marketing
Civil Aviation Safety Authority
P. 02 6217 1574 M. 0408 644245 F. 02 6217 1950
E. dennis.o'leary@casa.gov.au

From: Doug.Davy@CH2M.com [mailto:Doug.Davy@CH2M.com]
Sent: Tuesday, 1 May 2007 10:08 AM
To: O'LEARY, DENNIS
Subject: Aviation safety and industrial thermal plumes

Dear Mr. O'Leary,

I am a consultant in the United States involved with the environmental permitting of power plants. Although our national aviation safety administration has not paid much attention to the issue of aviation hazards that might be caused by thermal plume turbulence from power plant stack exhausts, this issue has been identified in California as a potential concern in several power plant siting cases. Australia appears to be in the forefront on this issue, and those of us trying to learn more about this issue have been studying the thermal modeling methods used there. We've also noticed that CASA uses a standard of 4.3 m/s as a thermal plume velocity that could damage the airframe. I'm wondering whether or not you would be able to help me understand how or why the CASA settled on this velocity as a screening level standard for possible air navigation hazards. Are there studies that were done in Australia or elsewhere that you could point me to?

Any assistance you could provide would be much appreciated.

Regards,

Douglas M. Davy, Ph.D.
Senior Project Manager
CH2M HILL
2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833
(916) 286-0278
ddavy@ch2m.com

Attachment 9

Instrument Approach for the LOC/DME Runway 28L

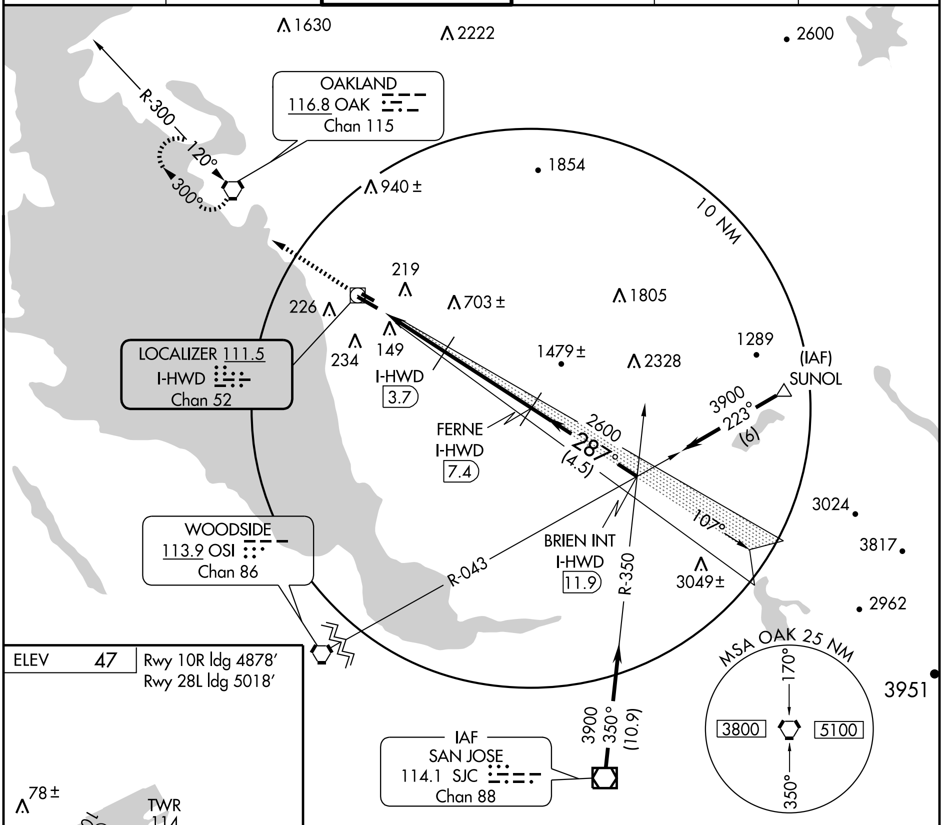
LOC/DME RWY 28L
HAYWARD EXECUTIVE (HWD)

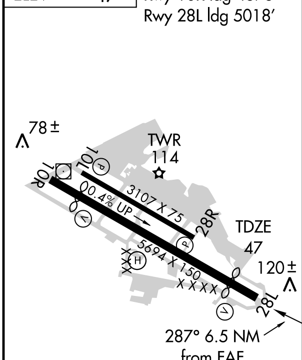
LOC/DME I-HWD	APP CRS	Rwy ldg	5018
111.5 Chan **52**	**287°**	TDZE	**47**
		Apt Elev	**47**

T A Circling not authorized north of Rwy 10L-28R.

MISSED APPROACH: Climb to 2000 direct OAK VORTAC and hold.

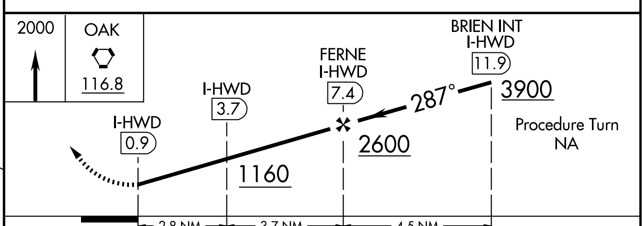
ATIS	NORCAL APP CON	HAYWARD TOWER★	GND CON	CLNC DEL	UNICOM
126.7	**124.4 351.8**	**120.2** (CTAF) L **257.8**	**121.4**	**128.05**	**122.95**





MIRL Rwy10R-28L L
MIRL Rwy 10L-28R
REIL Rwys 10R and 28L

Knots	60	90	120	150	180
Min:Sec					



CATEGORY	A	B	C	D
S-28L	400-1 353 (400-1)			400-1¼ 353 (400-1¼)
CIRCLING	540-1 493 (500-1)		540-1½ 493 (500-1½)	600-2 553 (600-2)

SW-2, 05 JUL 2007 to 02 AUG 2007